Jun 6th, 1:30 PM - 1:50 PM

Session C5 - Replacing Dam Functions when Removing a Dam

Laura Wildman
Princeton Hydro, LLC, lwildman@princetonhydro.com

Replacing Dam Functions when Removing a Dam

Presenters: Laura Wildman, P.E., Princeton Hydro, South Glastonbury, CT and Dave Monie, P.E., GPM Associates Inc, Cherry Hill, NJ

Session: Removing Barriers to Barrier Removal

Abstract: One of the more significant challenges when removing a dam is to replace the current functions the dam may server. Dams can server economically beneficial roles such as providing water supply, flood control, recreational opportunities, and hydroelectric power. These services often justify the costs associated with long term dam maintenance and liability, and can make removing a dam infeasible. Increasingly, however, there are examples of dam removal projects that seek to replace some of these services while still restoring free flowing conditions and fish passage to a river. This presentation will focus on multiple dam removal examples where water intakes were modified to allow for continued flow diversion, dewatered impoundments were configured to enhance flow attenuation, and recreational opportunities were transformed from values gained from impoundments to values gained from flowing rivers. In addition, as future advancements in free standing kinetic turbines and turbines placed on closed conduit systems continues to progress, we can envision a future in which dams are no longer a necessary component for harnessing power from a river and rivers are allowed to once again flow free.

20 min total – 15 min talk with 5 min Q&A

REPLACING DAM FUNCTIONS WHEN REMOVING A DAM

Laura Wildman, PE
Ecological Restoration Engineer

Princeton Hydro

Glastonbury, Connecticut, USA
860-652-9911
lwildman@amrivers.org

and

Dave Monie, P.E.
GPM Associates Inc, Cherry Hill, NJ

GPM associates, inc.

Drawing by Steve Varner

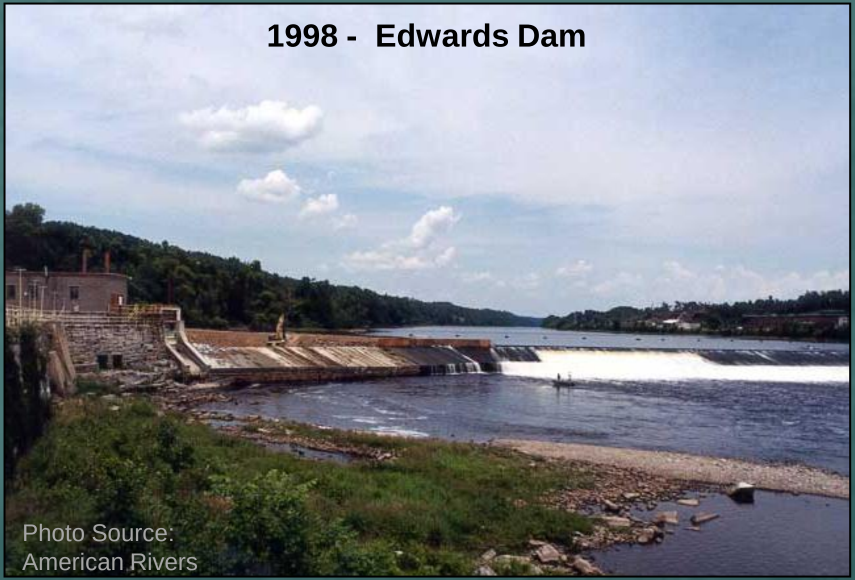
Values of Removing Dams

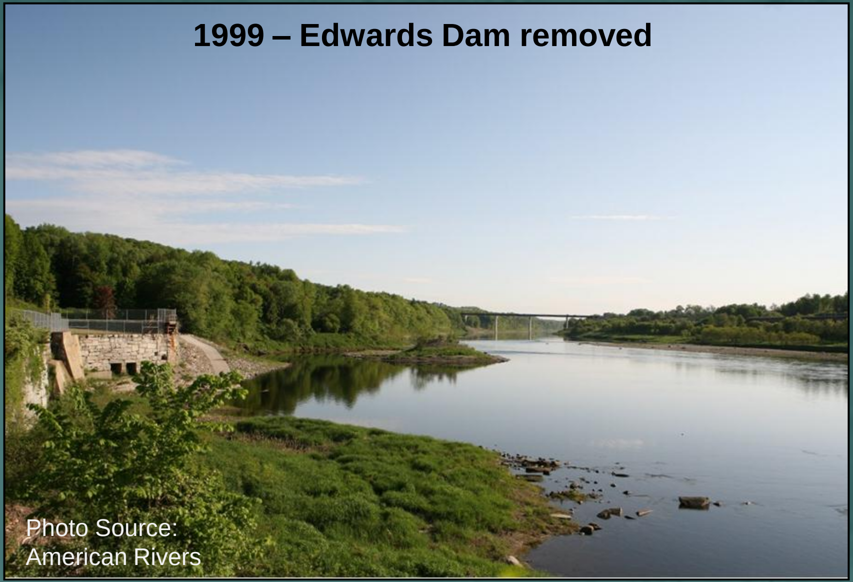
ECOLOGICAL VALUES:

- fish passage
- aquatic organism passage
- system defragmentation
- restored sediment transport processes
- restored debris transport – habitat building
- improved water quality
- restored riverine & floodplain function

ECONOMIC & PUBLIC SAFETY VALUES:

- remove risks associated with dam failure
- remove liability & maintenance costs
- recreational boat passage





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Values of Dams

- Water Supply
- Water Diversion
- Flood Control
- Recreational Opportunities
- Hydro Electric Power
- Navigation
- Road Crossing

These services normally justify the costs associated with long term maintenance and liability, and can make removing a dam infeasible.

Replacing Roles & Restoring Rivers

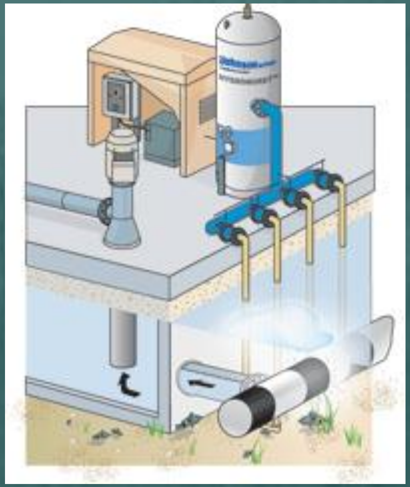
WATER INTAKE EXAMPLES:

- Cumberland Dam, Potomac River, MD
- Goldsboro Dam, Little River, NC
- Nevius Street Dam, Raritan River, NJ
- Barrier #1 Dam, Little Lehigh River, PA
- Greenfield Pumping Station Dam, Green River, MA
- Becket Dam, Yokum Brook, MA

Removing Dams and Modifying Water Intakes

Modify Existing Intake by:

- Reconfiguring intake & pump station layout
- Relocating intake (i.e. scour pool, sunken intake, extend upstream, slip stream)
- Off-line bypass channel
- Modify pumps: capacities/elevations/
  Submersible → Self priming (might need to modify electrical supply)
- Gravity feed → Suction feed
- Perforated Pipe or Screened intake with air scouring system



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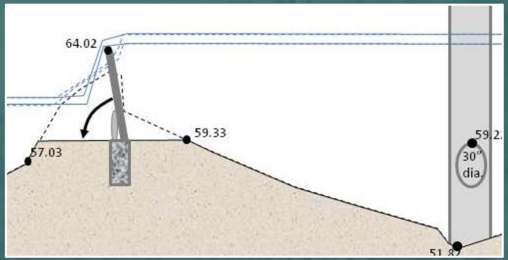
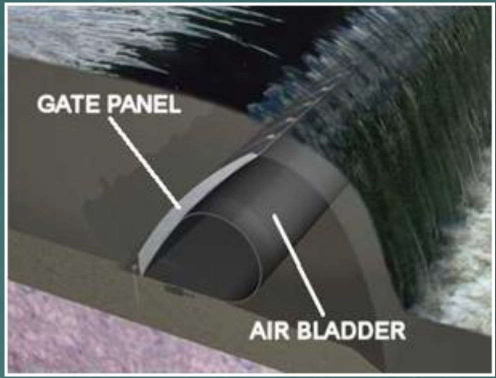
Removing Dams and Modifying Water Intakes

Other Options:

- Wells
- Off-line storage facility (i.e. tank, pond)
- Siphon
- Slop-log, hinged, inflatable or gated dam for infrequent use
- Etc.





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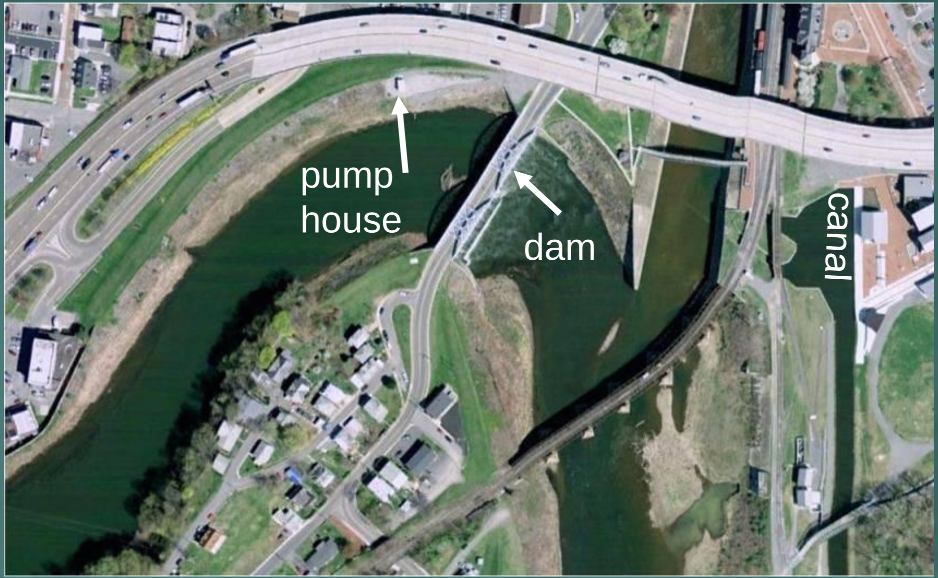
Cumberland Dam, Potomac River, MD

- Use: Water supply for a restored segment of a National Park Service historic canal
- Demand: 5.2 MGD (maximum needed if more of the canal is rebuilt)
- Current intake: gravity feed pipe above dam to a pumping station
- Proposed: remove dam and, screened intake, air scouring system, and suction line with self priming pumps.
- Cost: $200K - $500K



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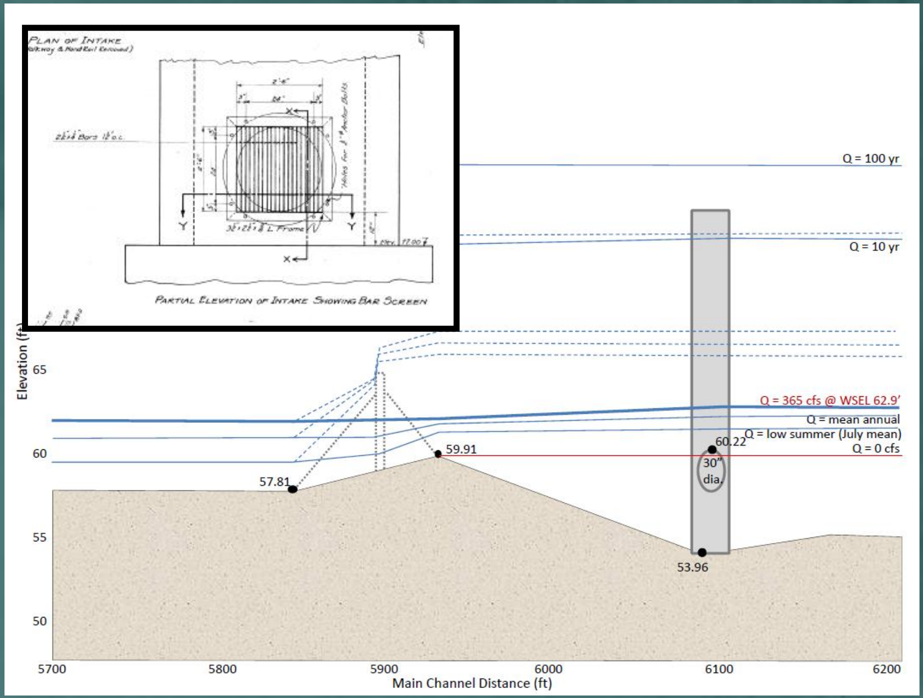
Goldsboro Dam, Little River, NC

- Use: Backup water supply – rarely used, but have sedimentation problems at main intake
- Demand: 6 MGD, then 9 MGD, then wanted impoundment storage capacity too
- Current intake: gravity feed pipe above dam to pumping station
- Proposed: Remove dam, stabilize riffle, and reposition internal pump house suction pipes in the wet well to reduce chance of vortex formation
- Cost: \$100K to \$200K



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Nevius Street Dam, Raritan River, NJ

- Use: water supply for an estate/park
- Demand: 1 MGD
- Alternatives: lowering & notching; client did not want to modify current intake configuration and elevation
- Current intake: gravity feed pipe above dam to a pumping station; with a stable riffle downstream of dam that partially submerges dam and shallow bedrock at the inlet
- Proposed: Notch dam
- Cost: $10K to $20K

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Barrier #1 Dam, Little Lehigh River, PA

- Use: City water supply
- Demand: authorized withdrawal 30 MGD, use ~3 MGD but want full capacity maintained
- Current intake: gravity feed pipe above dam with roller screen to pumping station
- Proposed: Remove dam and convert to a large scale in-channel screened intake with aerators
- Cost: $10 million - $15 million

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Greenfield Pumping Station Dam, Green River, MA

- Use: backup summer water supply (~21% of total need)
- Demand: 2.1 MGD
- Current intake: gravity feed pipe above dam to sand filters, collection facility and pumping station, then pumped to water treatment facility – then dam breached
- Proposed: Keep dam out, gravity feed from self scouring pool to pumping station, bypass sand filters; pre-treat elsewhere

Dam Failure

Sand filters and Pumping Station

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Ballou Dam, Yokum Brook, MA

- Designed by: Milone & MacBroom, Inc.
- Use: fire suppression for a school
- Demand: 40,000 gallons per event
- Current intake: fire trucks pump from pool behind dam
- Proposed: Remove dam and gravity feed to an underground storage tank
- Cost: $20,000

Middle Fork Nooksack River Diversion

Design by: Black & Veatch Corporation

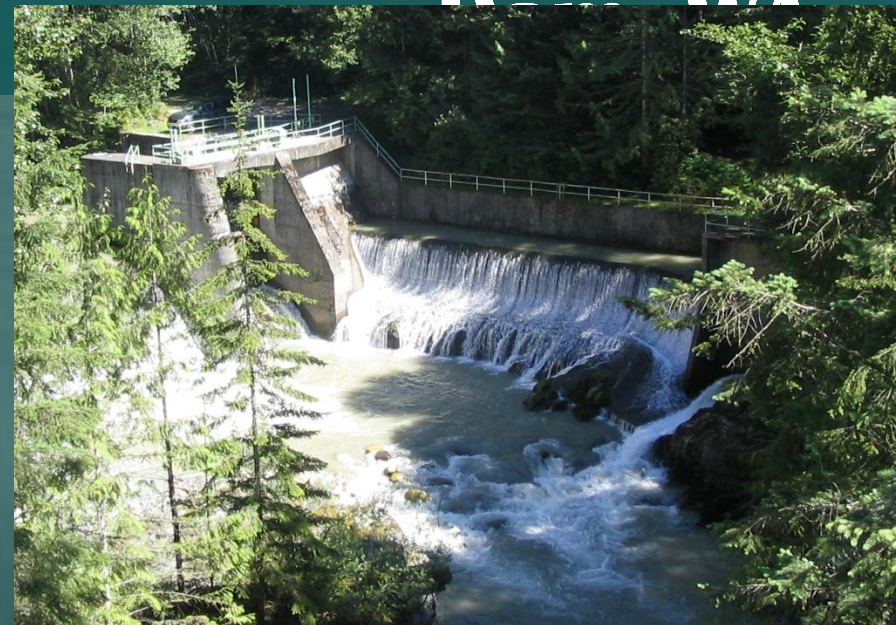
Uses: Primary water source

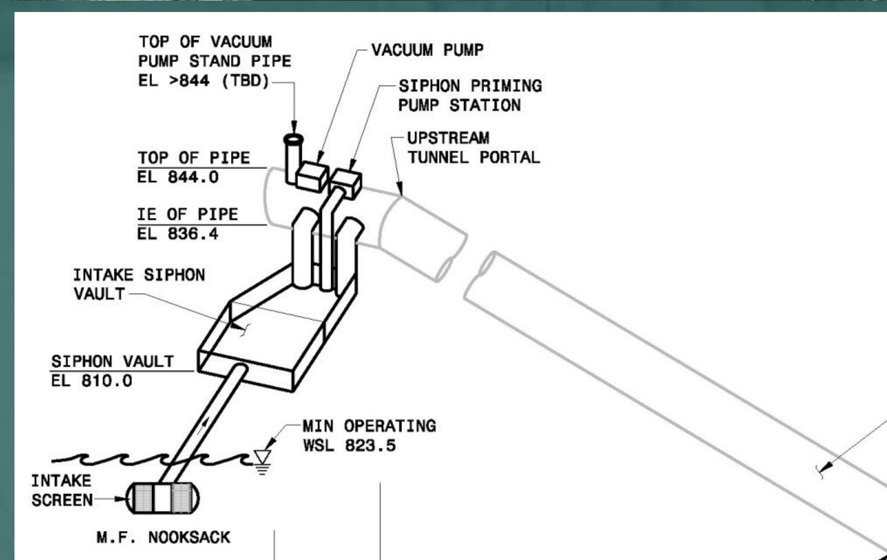
Demand: 75 MGD capacity

Current intake: gravity flow headrace to a diversion tunnel

Proposed: in-channel screened intake to a siphon, then to diversion tunnel

Cost: $10-$22 million for earlier alternatives





Feasiblity vs Implementation

Dam	Intake Need	Proposed Solution	Is Dam Removal Feasible?	Was Proposal Implemented?
Cumberland	3 MGD	Screen intake with air scouring system, convert to suction line and self priming pumps	Yes	Not Yet
Goldsboro	9 MGD	Modify internal wet well pipe configuration	Yes	No
Nevius	1 MGD	Notch dam	Yes	Not Yet
Barrier #1	30 MGD	Screened in-channel intakes with air scouring system	No – too costly	No
Greenfield	2.1 MGD	Gravity feed, bypassing sand filters; pre-treat elsewhere	Likely	No
Ballou	40,000 Gal.	Underground storage tank	Yes	Yes

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Replacing Roles & Restoring Rivers

FLOOD CONTROL: Attenuation through final configuration or vegetation

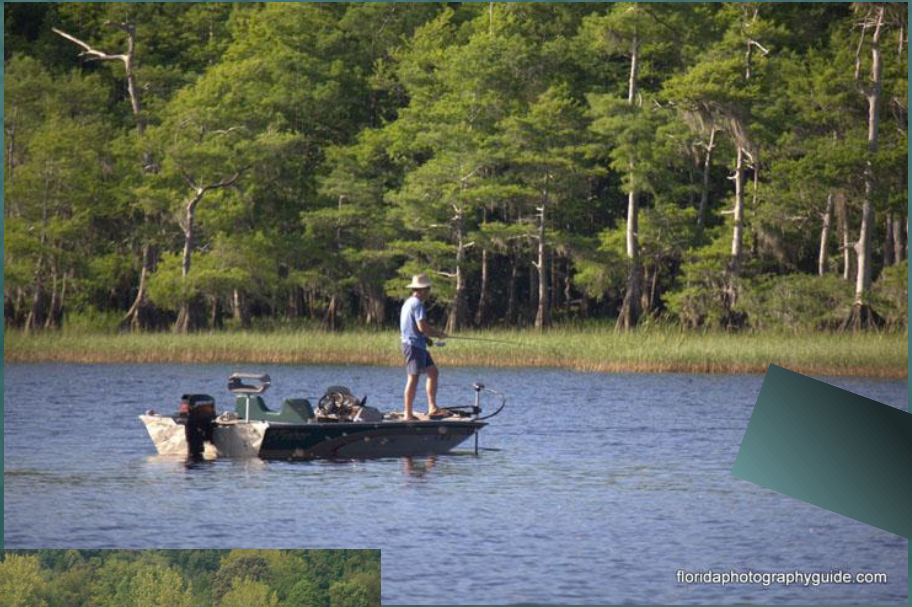
Charles River, MA - The Giant Sponge

- 1983 acquisition & protection of 17 natural valley storage areas
- **Totaling 8,103 acres**
- USACE estimate of annual flood control benefits at $17 million/yr

Source: CIFMCG Workshop 2006; Comprehensive Floodplain Management: Promoting Wise Uses of Floodplains & photos from the internet

Replacing Roles & Restoring Rivers

RECREATIONAL OPPORTUNITIES: Replacing one type of recreation with another type of recreation



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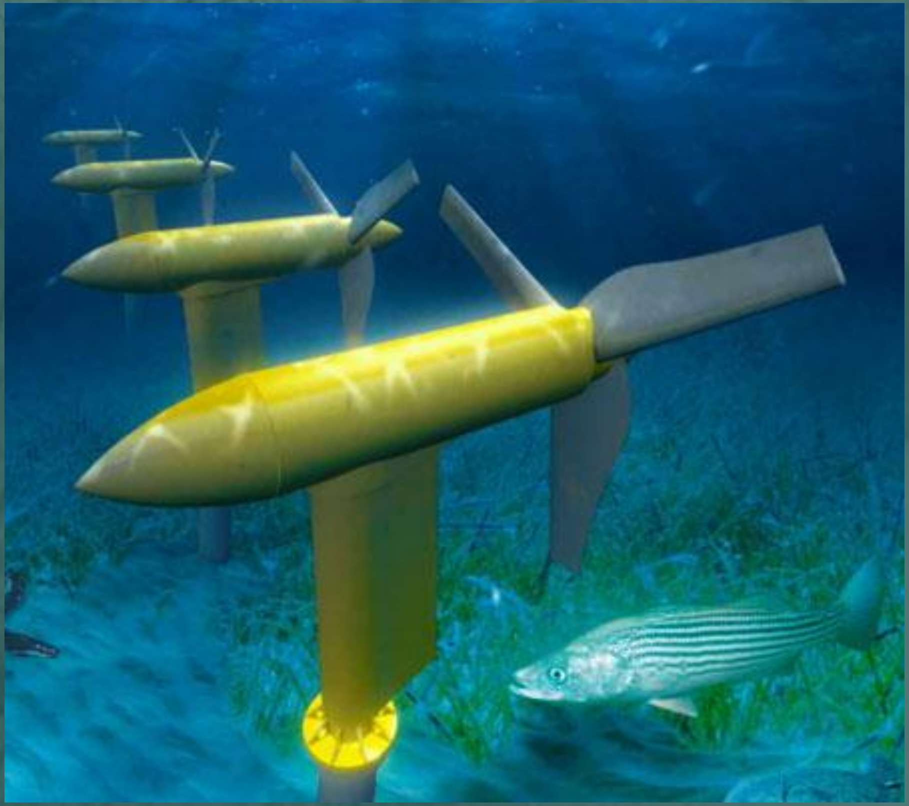
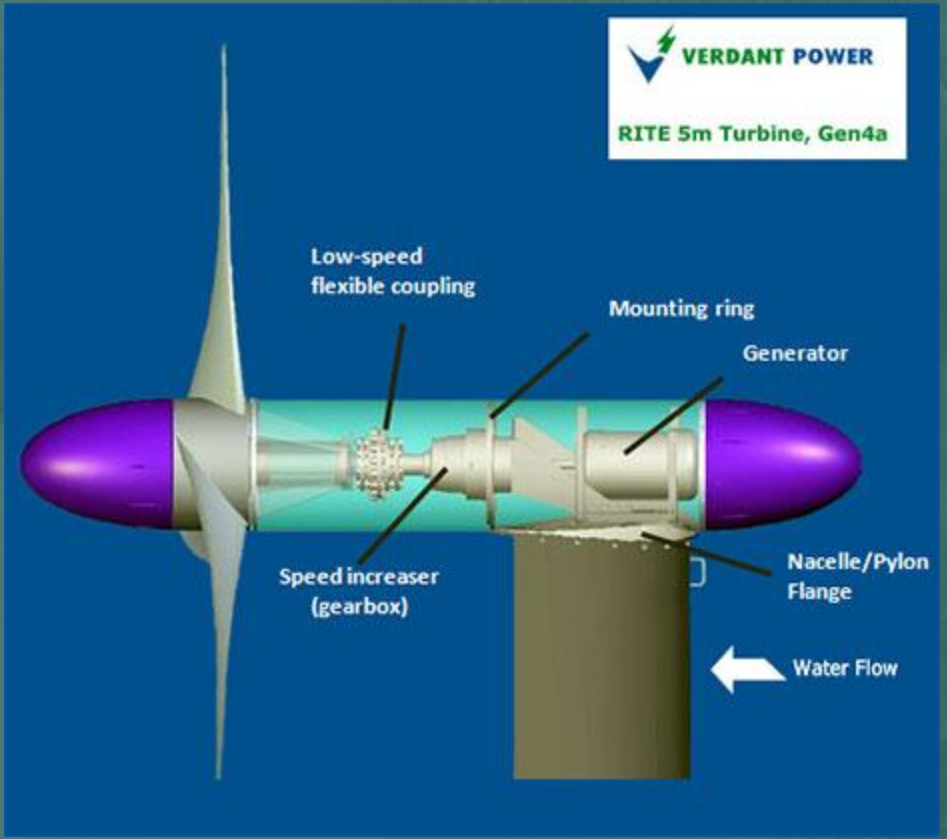
HYDRO ELECTRIC: One possibility maybe to utilize free standing kinetic turbines and turbines placed on closed conduit systems continues (i.e. water and sewer transmission lines)





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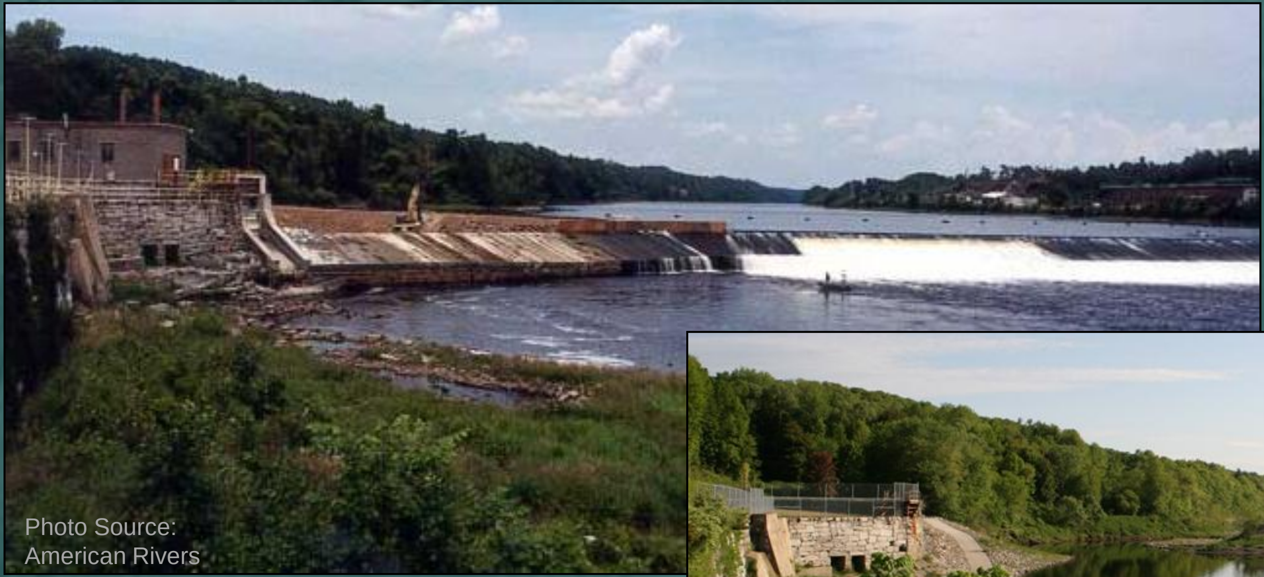
St Lawrence River http://www.treehugger.com/renewable-energy/hydro-power-without-the-dams-ontario-

Restoring the Balance Back to What a River Freely Offers

Creative Balancing of River Uses, Sustainable Approaches, and Restored Free Flowing Rivers



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Thank You

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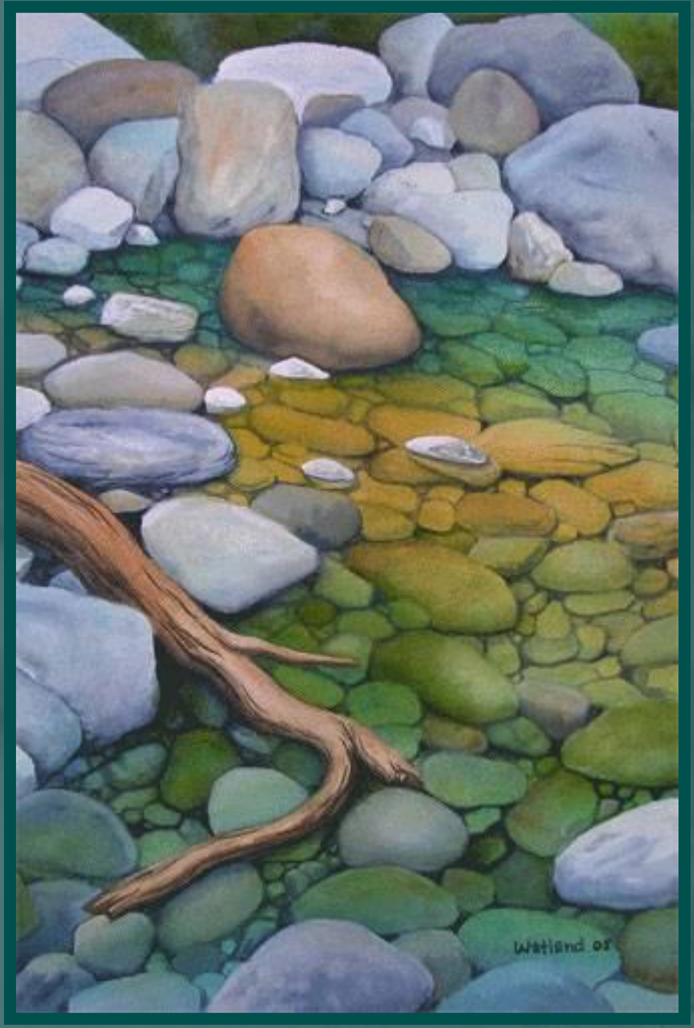

Drawing by Steve Varner